Pratt & Whitney

EVMS - Implementing and Maturing an Enterprise Level Solution

2006 Project Management Challenge Conference
March 21 & 22 2006

NOTICE

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Agenda

- Pratt & Whitney
- ERP Program Overview
- Program Management/EVMS
- The Journey Continues

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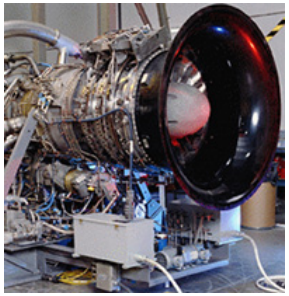
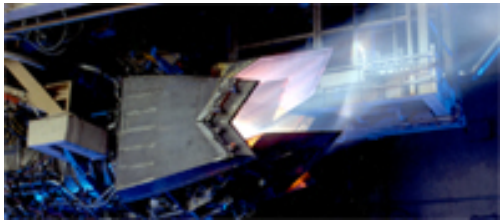


Power Systems

Specialty Materials & Services

P&W Rocketdyne

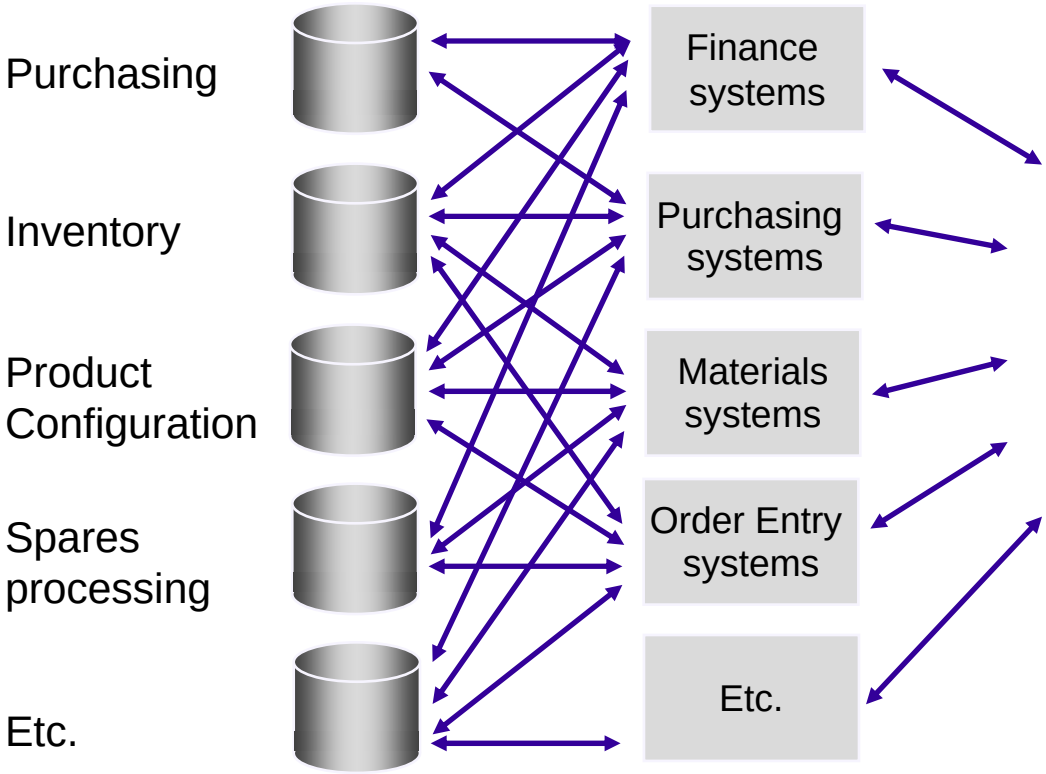
P&W Canada



Military Engines

Large Commercial Engines and Aftermarket Services

Data/Information Transformation



Key Master Data	# of Master Files	SAP
Chart of Accounts	16	1
Bills of Material	40	1
Customers	29	1
Cost Centers	9	1
Employee	68	1
Equipment	80	1
Materials	71	1
Vendors	36	1

Developed incrementally over 30+ years

ERP is targeting ~ 650 Legacy Systems for Retirement

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Top Level Commitment!

Internal
Correspondence

Pratt & Whitney
A United Technologies Company

To: Pratt & Whitney Management

Subject: Requests for Information Technology Services

Date: December 7, 1999

As you know we completed a major outsourcing contract with Computer Sciences Corporation (CSC) for the delivery of information technology services. As our IT service provider, CSC has been directed to concentrate system development and modifications toward the completion of our Enterprise Resource Planning (ERP) program. We must move with increased speed to complete the implementation company-wide over the next two years.

To ensure this, no new system development activities or modification to legacy systems will be authorized outside of ERP without a business benefits review and evaluation. The process will start with a P&W Executive as sponsor of an IT services request. This request will be evaluated for business value and fit within the ERP program. The process is outlined on the back of this page.

I know we can count on your full and complete support as we work to make ERP a 'game changer' for our company.

Louis Chênevert
President

Jothi Purushotaman
Senior Vice President - Finance

"…no new system development activities or modifications to legacy systems will be authorized outside of ERP without a business benefits review and evaluation."

Louis Chenevert
Letter to P&W Management
December 1999

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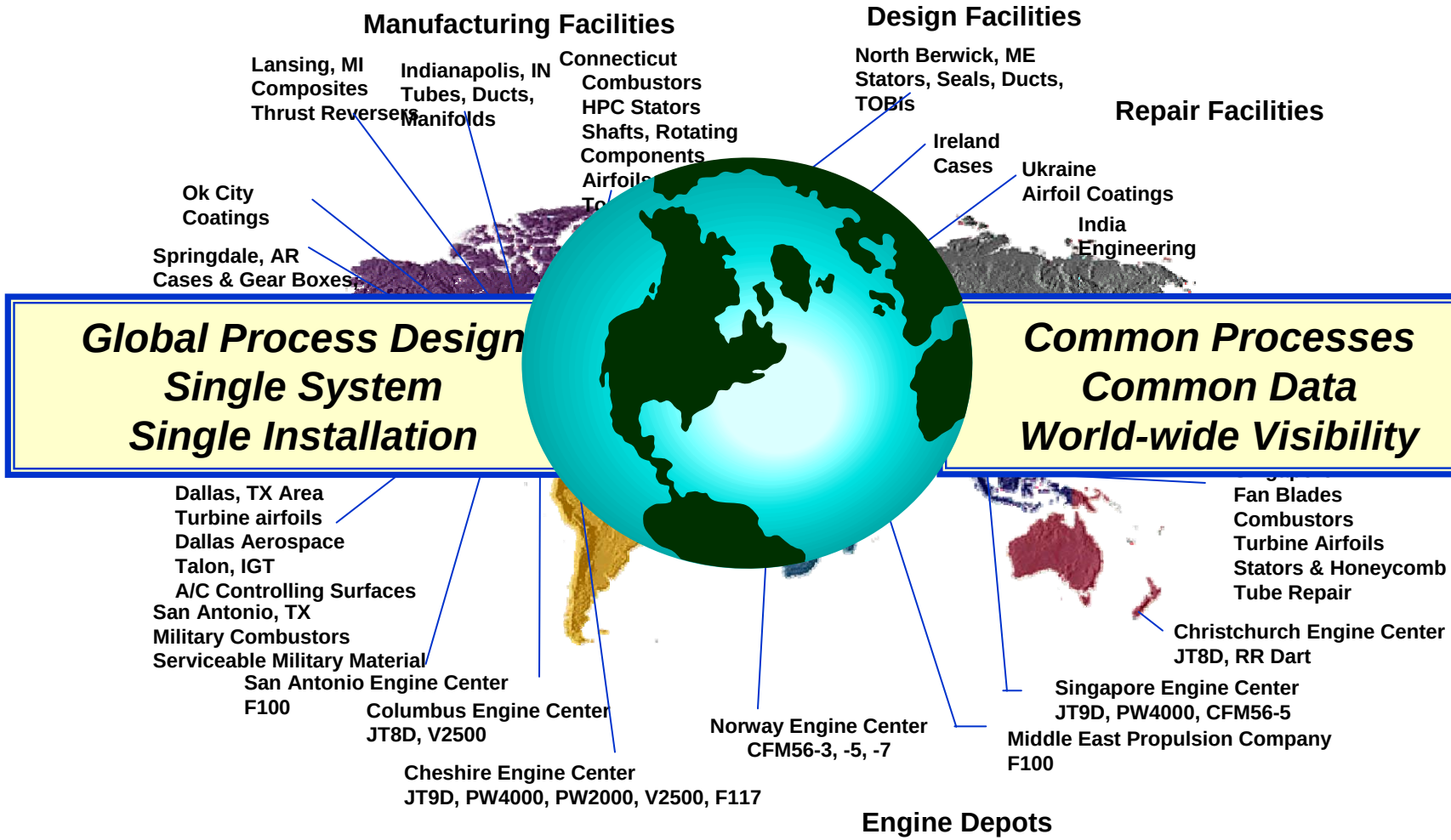
P&W's Global Business System



Single Instance Strategy….Critical Early Decision!

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ERP Phased Implementation

1999/2000

7/99 - Phase 1 (ESA)
• Finance/Proc./MRO

10/99 - Phase 2 (P&W)
• **Core Finance**
• GL/AP/Fixed Assets/ Budget/Actuals/BW

3/00 - Phase 2 (P&W)
• **Warehouse Logistics**
• Parts Tracking / BW

5/00 - Phase 3 (ESA)
• **MRO (part 2)**
- Phase 3 (P&W)
• Plant Maint. / BW

8/00 - Phase 3 (P&W)
• **Engine Assembly & Costing**
• CM/EWI/Labor Collection/BW

10/00 - Pratt Canada
• Business Warehouse

11/00 - UTC
• Business Warehouse

2001

1/01 - Phase 3 (P&W)
• Labor Collection

8/01 - Phase 4 (P&W)
• MRO (Cheshire)
• Component Repair
• **Material Valuation**
• Spares Order Processing
• Engine Sales Orders
• **Procurement**
• **MRP**
• Quality Management
• Plant Maintenance
• Labor Collection
• Business Warehouse

11/01 - (P&W)
• Product Data Management

2002

2/02 - Phase 5 (P&W)
• MRO (Columbus)
• **EH&S**
• Plant Maintenance
• Business Warehouse

6/02 - (P&W)
• MRO (Norway)

8/02 - Phase 5A (P&W)
• **Component Repair (EH)**

10/02 - Phase 5B (P&W)
• **Program Management**
• **Product Design & Validation**
• Product Data Management for Devl.
• Labor Collection
• Space (Full Solution)
• F117 Flex Program
• Customer Owned Property
• Quality
• Tooling
• Business Warehouse

11/02 - (P&W)
• Military Component Repair (Oklahoma City)

2003 - Present

2003
•Supply Chain Management (SCM Demand Planning)
•Raw Material
•IAE Spares

2004
•Military Spares
•Repair Operations
•Third Party Logistics
•Order to Cash
•MRO Paperless Overhaul
•SCM - Supply Network Planning

2005
•Upgrade to R/3 4.7 Enterprise
•MRO Deployments
•Engine Alliance Spares
•Supplier Managed Inventory

2006
•Component Production

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Product Development at P&W

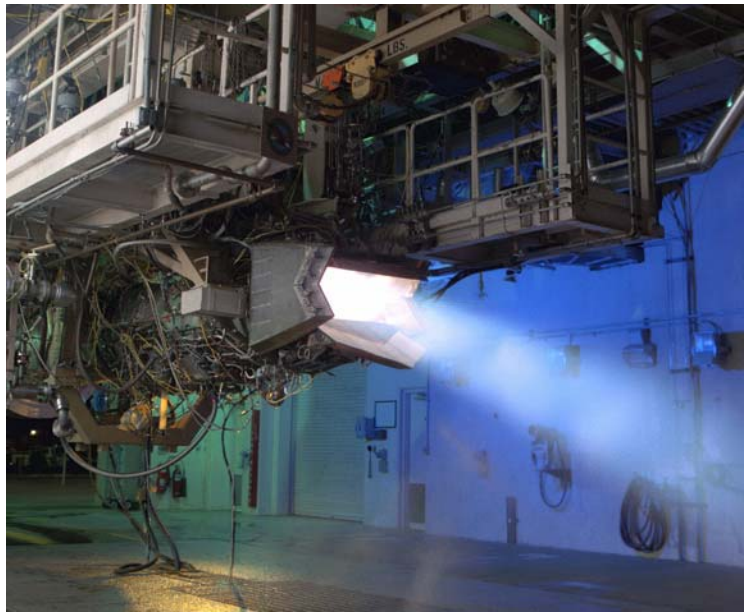
~ $1B Annual Product and Technology Development Spend

Externally Funded via Contracts

- F135 Joint Strike Fighter
- F119 F22 ATF
- SSME HPTP
- RL10 AATS
- Hypersonics
- CIP

Internally Funded (E&D)

- PW6000 (A318)
- GP7000 (A380)
- Space
- Technology Programs



ALL development planning and cost collection performed in SAP.

Over 2000 Projects!

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Program Management/EVMS

System Must…

- Incorporate integrated cost and scheduling for large programs
- Provide complete program baseline control
- Deliver EVMS tools that are robust and comprehensive
- Enable full integration between suppliers and OEM contractors
- Have the ability to produce accurate EACs and USG required reports
- Include robust change control and auditability
- Be simple to use and navigate through

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Evolution to Enterprise EV Management

More than Just a System Change…

2000

Multiple:
- Tools
- Processes
- Metrics
- EV for ME only

ERP Program Management project begins

EVMS Organization Formed

Common Metrics And Reporting (wInsight)

	WBS	DESCRIPTION	LVL	LL	SV	CV	VAC	VAR	BAC	%C	CPI	SV	CV	VAC
1	3200	COMMUNICATIONS	3	√	↑	↓	↔	sc	2,043.0	34.63	0.844	-203.2	-130.8	-87.0
2	3700	DATA DISPLAY	3	√	↑	↔	↔	S	388.0	41.13	1.000	-113.0	0.0	0.0
3	3300	AUX EQUIP	3	√	↑	↓	↑	sc	2,418.2	27.57	1.133	-93.2	78.2	8.4
4	G&A	GEN & ADMIN	2	√	↓	↓	↔		1,850.4	33.67	0.932	-39.0	-65.2	-36.8
5	3100	SENSORS	3	√	↑	↓	↔		1,728.4	20.87	0.971	-36.6	-10.6	-21.6
6	2100	PROJ MANAGEMENT	3	√	↓	↔	↔		618.4	45.70	0.942	-12.0	-17.4	-3.2
7	3600	PCC	3	√	↓	↑	↔		5,800.6	28.99	0.850	-11.4	-296.2	-187.2
8	3400	ADPE	3	√	↓	↓	↔	c	599.2	41.89	1.053	-10.2	12.6	4.6
9	2300	FUNC INTEGRA	3	√	↓	↓	↔		482.8	71.62	0.952	-7.6	-17.4	-30.8

2002

ERP Implemented!

Single tool
Common Process
Real-time Data
EV for all Programs

2003 to Present

Enhancements

EV Tool Box

E C/Svar

wInsight Upgrades

Training

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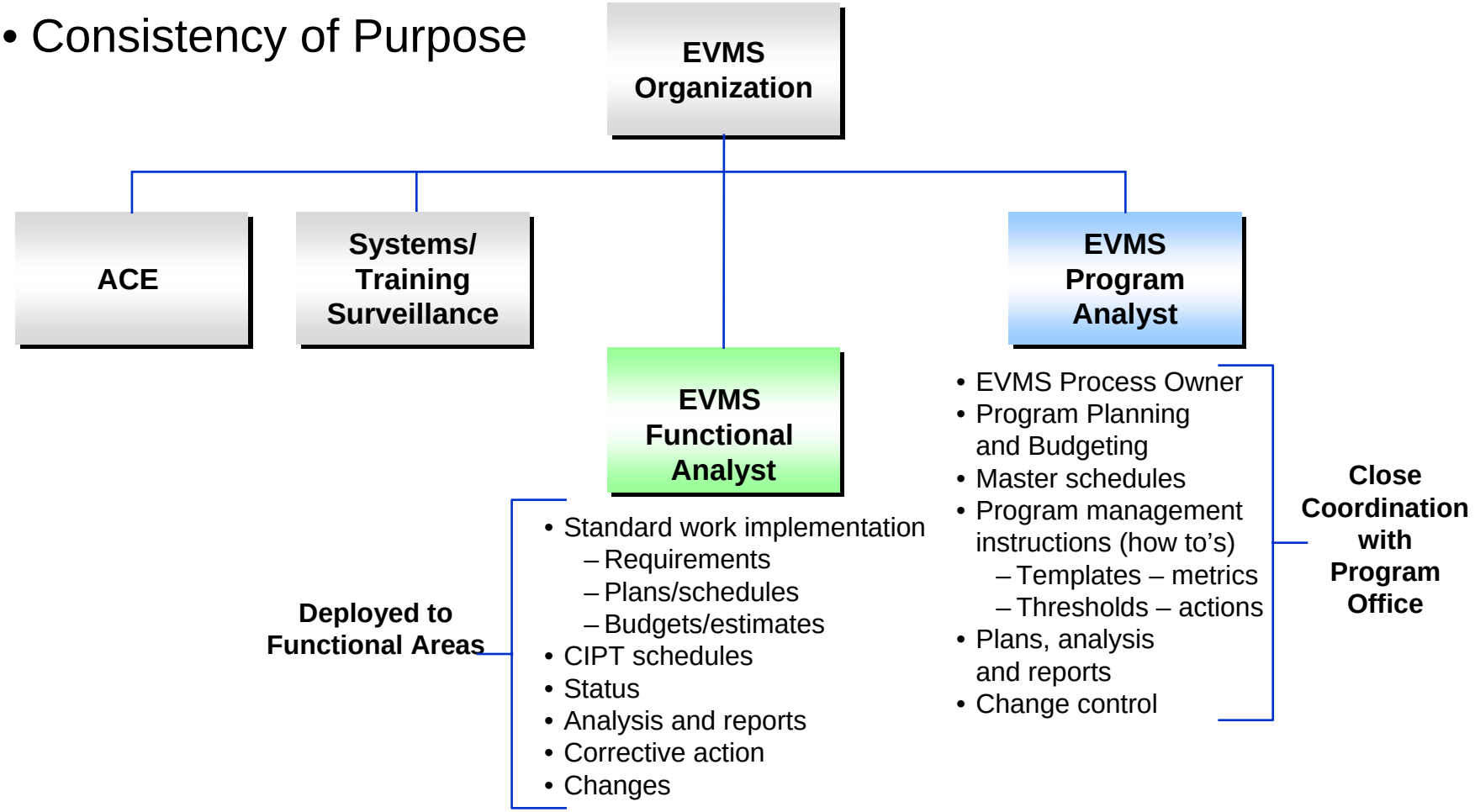
EVMS Organization Formed!

- Drive Culture Change
- Consistent Process and Tools
- Consistency of Purpose



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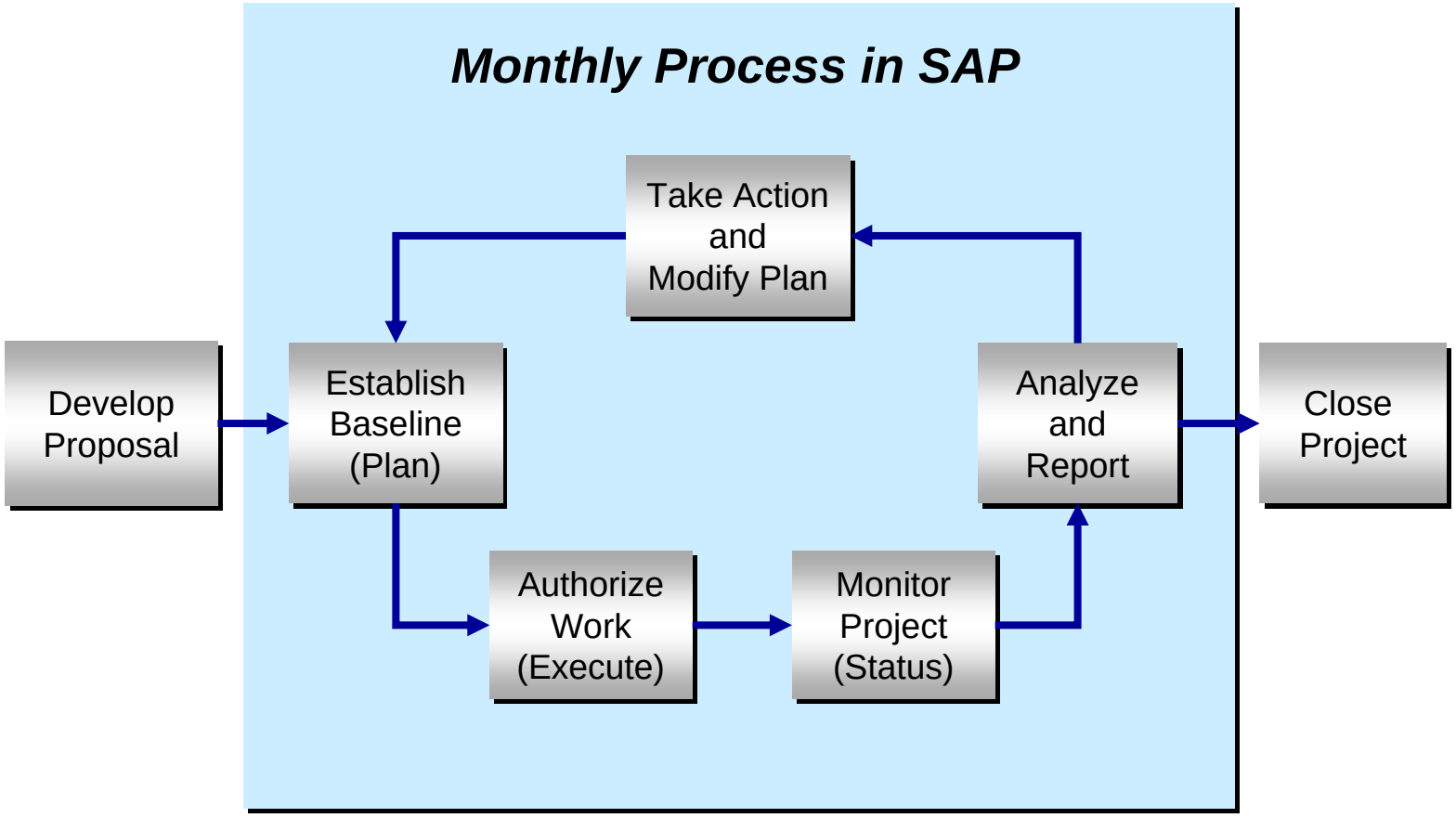
EVMS Overview at P&W



Single….Standard Process Established Across the Enterprise

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ERP EVMS Implementation Goals

- Standardization
  - Business Process
  - WBS structure
  - Metrics and Reporting
  - Labor forecasting
- Improved Visibility to Program Data
  - Actual costs near real-time
  - Cost detail drill down
  - Open Commitments
  - Timely reporting
- Less Paper!
  - Work Authorization
  - Program performance

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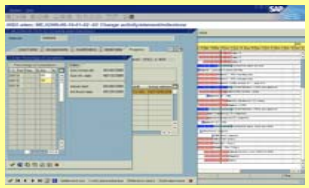
Pratt's IT Toolset for EVMS

SAP PS



All Program Data

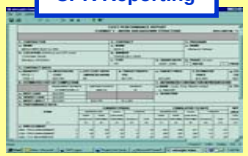
- *Plans – resource and cost plans*
- *Schedule*
- *EV Methods*
- *Baseline*
- *Actuals*
- *Earned Value (BCWP)*
- *Estimate at Complete (EAC)*

SAP EVC

wInsight

Performance Trending

CPR Reporting



EV & Customer Reporting

Business Warehouse (BW)

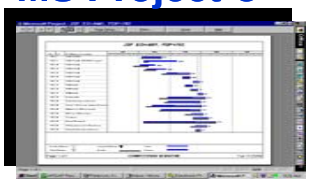
Snapshot of spend profiles, manpower

Reports/Queries

Documentum

Work Authorization Documents

MS Project ®



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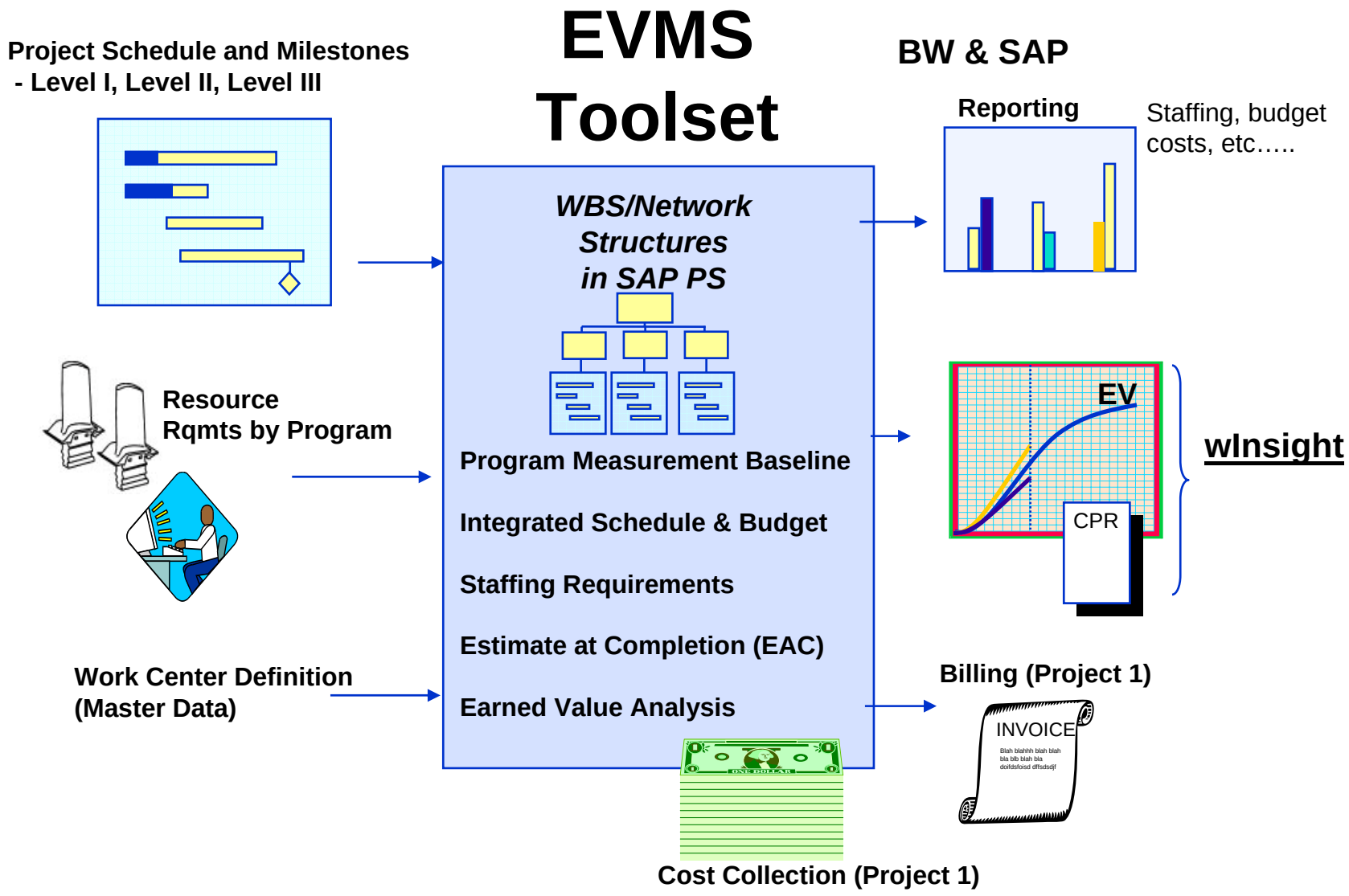
Program Management in SAP



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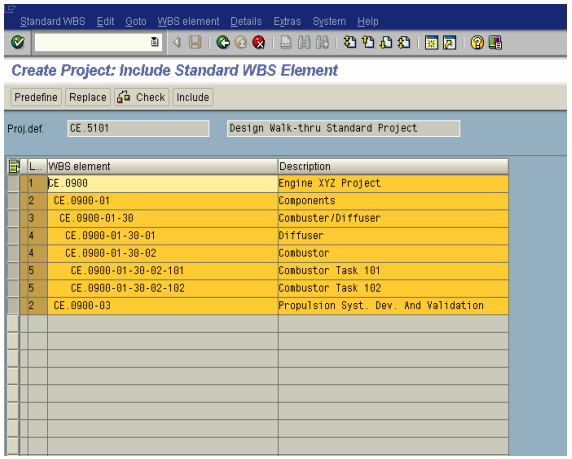
WBS and Network Structure



WBS

- Aligns with Budget and EVMS Responsibilities
- Aligns with contract line item/billing requirements

NetWork Activities

- Schedule (constraints, durations, relationships)
- EV method and status
  - Milestone, Percent Complete, 0 -100, Level of Effort (LOE)
- Integration with PM, SM orders

Activity Elements

- Resource Plan/Actuals
  - Work Center Hours and dollars
  - Hardware (direct mat'l) plans
  - Other costs plans and actuals
  - Integration with PO and PP orders
- Earned Value metrics

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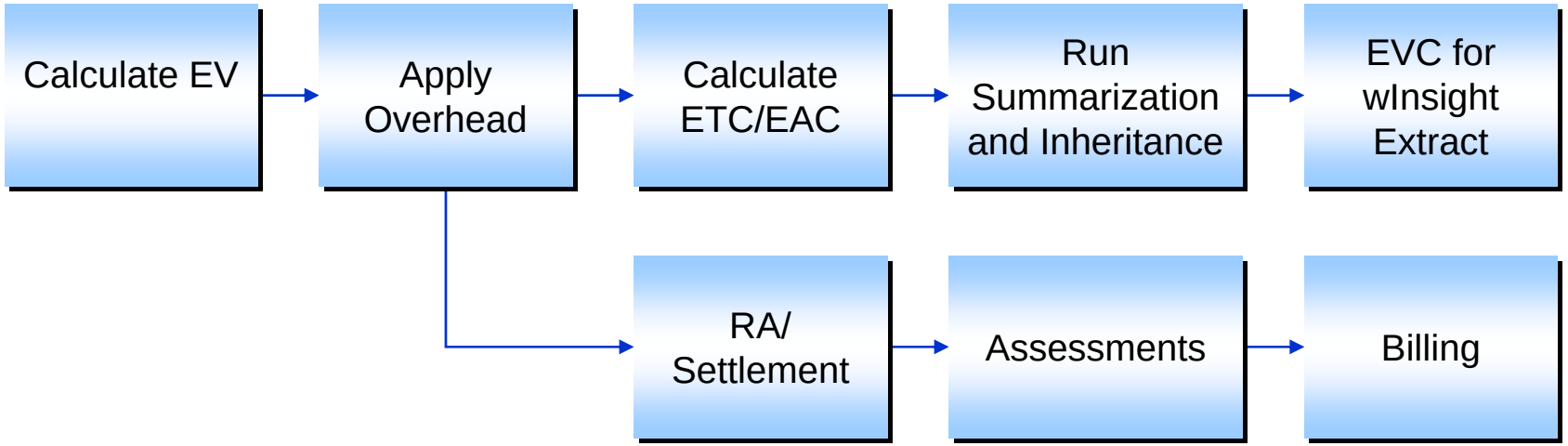
EVMS Month End Processing

Majority of EVMS data is the result of real-time transactions

However,

EVMS Month-end closing is executed by the IT team in background as part of the Financial closing.



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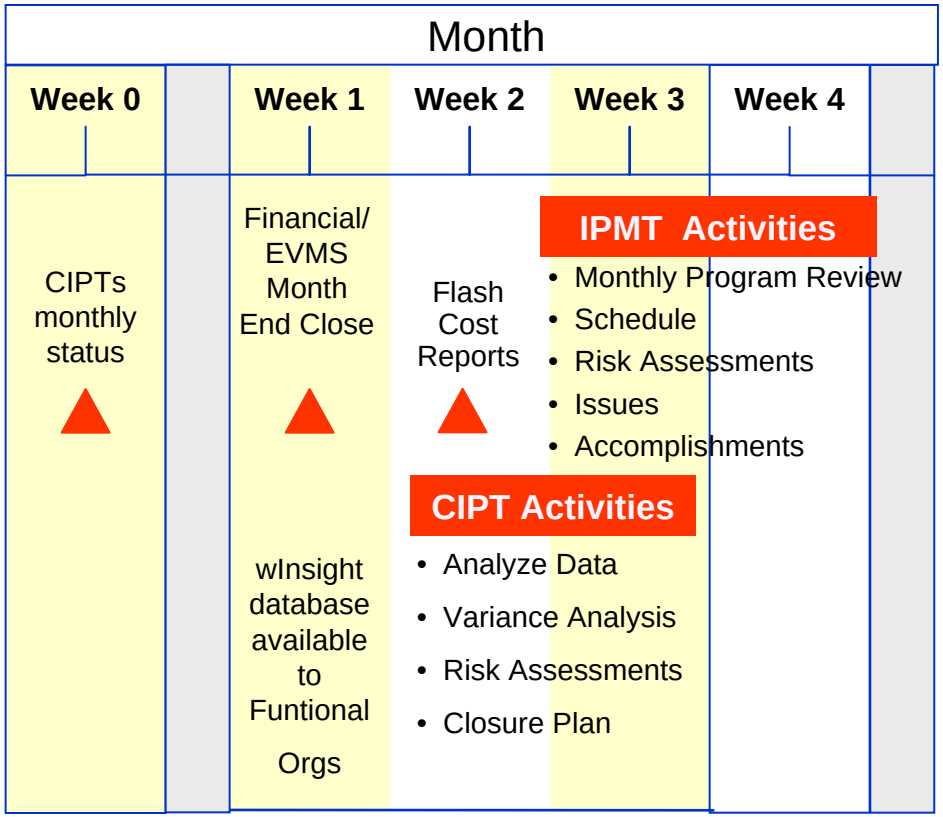
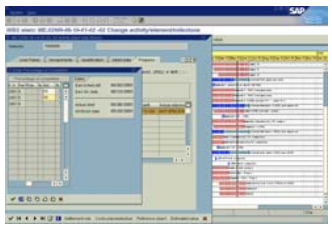
Monthly EV Process (Timeline)

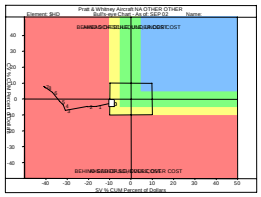


SAP

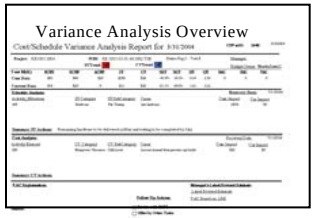


wInsight

Bull's Eye



E C/Svar



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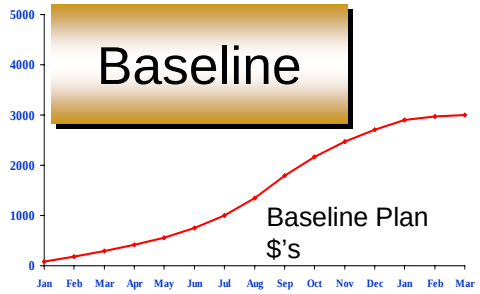
Change Control – Baseline & EAC



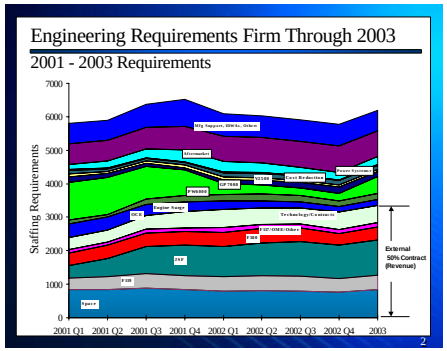
- Approved Work Scope Changes
- All changes documented

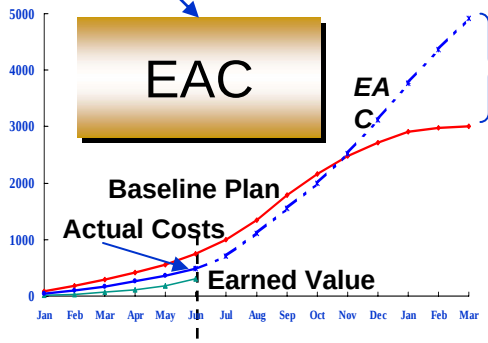
Workscope Changes

Plan Revisions

EAC Changes

Manpower Plans





- Approved EAC Changes
- All changes documented
- Must be consistent with funding levels

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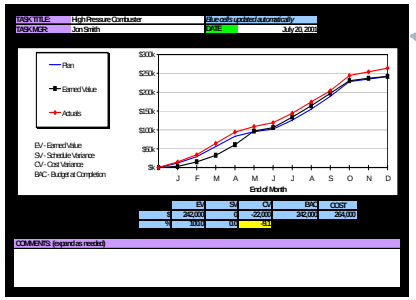
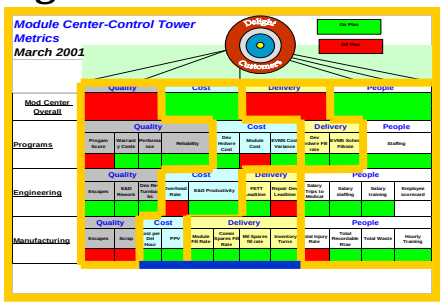
Common Metrics

Monthly Program Reviews



Programs **Information Flow** Module Centers

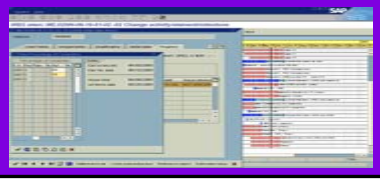
Organizational Metrics



Standard & Disciplined Approach Required Across Programs & Module Centers

EVMS Program Analyst

EVMS Functional Analyst



Customizations

- Baseline creation and maintenance
- Work Authorization – documentation and archival
- EAC calculation
- SAP Reporting (Report Painter and ABAP)
- System Performance!!

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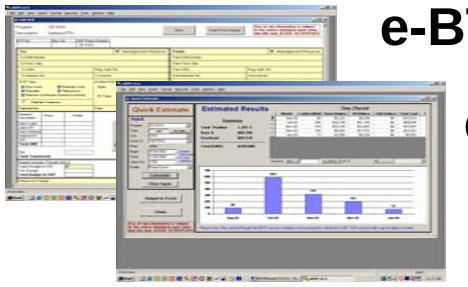
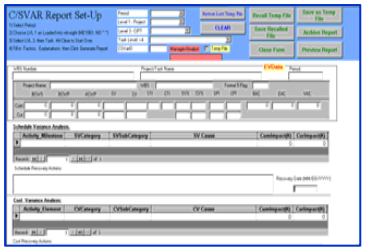
e-Business Tools..Ease of Use

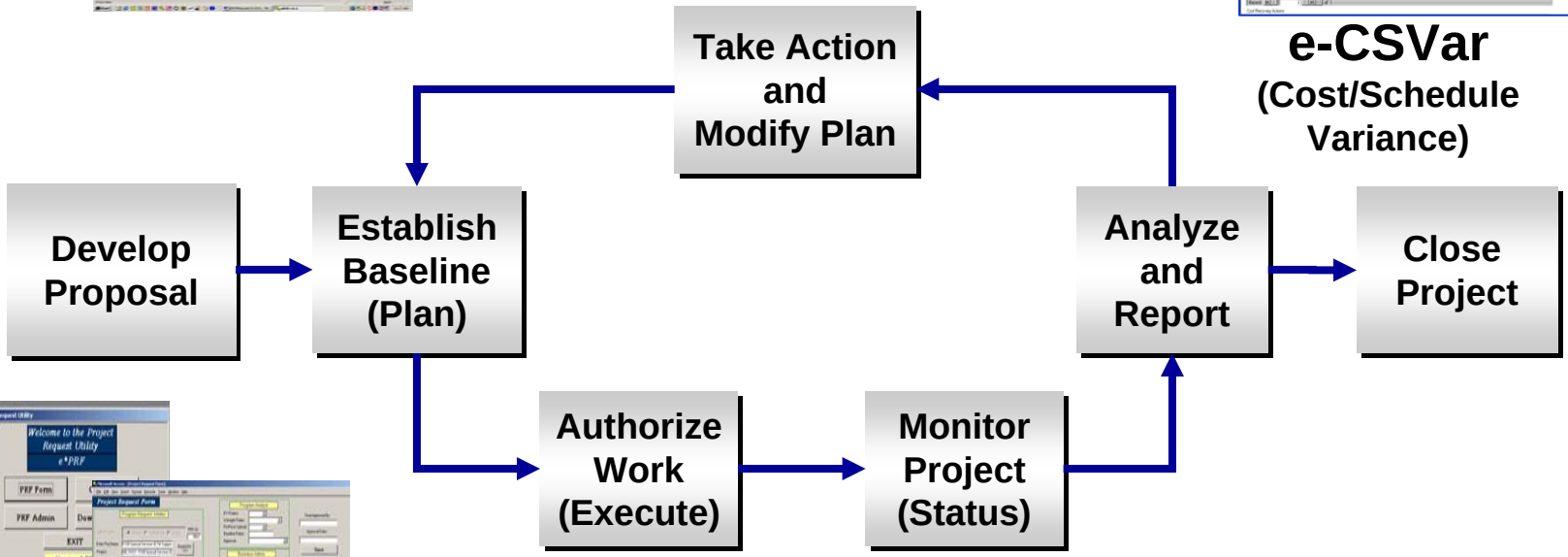


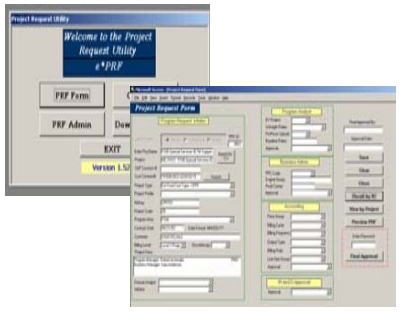
e-BTR (Budget Transfer Request)

e-EAC (EAC Change Request)



e-CSVar
(Cost/Schedule Variance)





e-PRF (Project Request Form)

Post Go-Live Efforts

- ✓ **Contract Rollover** – business process and functionality to facilitate movement of WIP, material etc., from one project to another
- ✓ **Proposal (ProPricer) Conversion –** import plans to SAP PS
- ✓ **Travel and Expense**
- ✓ **More Reports** – Well over 100 and still growing. Reports added for data validation and planning, not just management reporting.
- **Ease of Use**
  - ✓ System/User status maintenance screen
  - ✓ Baseline/EAC maintenance
  - EV Cockpit
  - EV Toolbox
- **Integrated Master Schedule Integration**

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Keep An IT Team Intact

Development/Go-Live

PW Subject Matter Experts: 9

IT Technical: 5-6

Consultants: 4

Plus help from SAP consulting for system performance improvements.

Sustaining

PW: 4-5

IT Technical: 3

Consultants: 0.50

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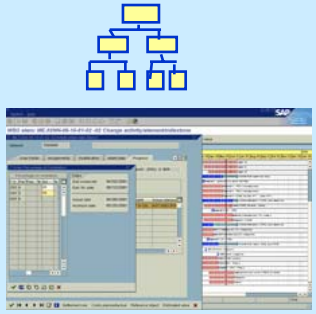
Big Hits at Pratt & Whitney

Project Plan, EV and Costs



$

Goods receipts

Labor hours & $s

Services

Actual $ when invoiced

Integration!

- Data timeliness
- Visibility to details

BW Reporting (particularly staffing)

Engine Group Charging Heads b

Activity element		Fisc			
Network		Network activity		Program Position	
Project definition		Value type		WBS element	
Work center		Key Figures			

	Fiscal year/period	January 2003	February 2003	March 2003	April 2003
	Value type	Actual	Actual	Actual	Actual
Work center		Charging Hds	Charging Hds	Charging Hds	Charging Hds
Overall Result		**240.1**	**286.5**	**246.3**	**251.5**
4000/EV	Earned Value Management System	237.9	281.1	244.1	248.4
4000/EVA	Engineering	237.1	280.1	242.7	246.8
4000/EVAA	Technical Engineering	223.0	260.9	222.9	222.3
4000/EVAB	LCE-Non-Technical Engineering	14.2	19.2	19.7	24.4
4000/EVAC	LME-Non-Technical Engineering				
DOP1/EVB	Development Operations		0.1		0.0
4000/EVC	Fabrication Technology	0.8	0.9	1.5	1.6
Not Assigned Work center (s)		2.2	5.4	2.1	3.0

Common process for Military / Commercial / Space

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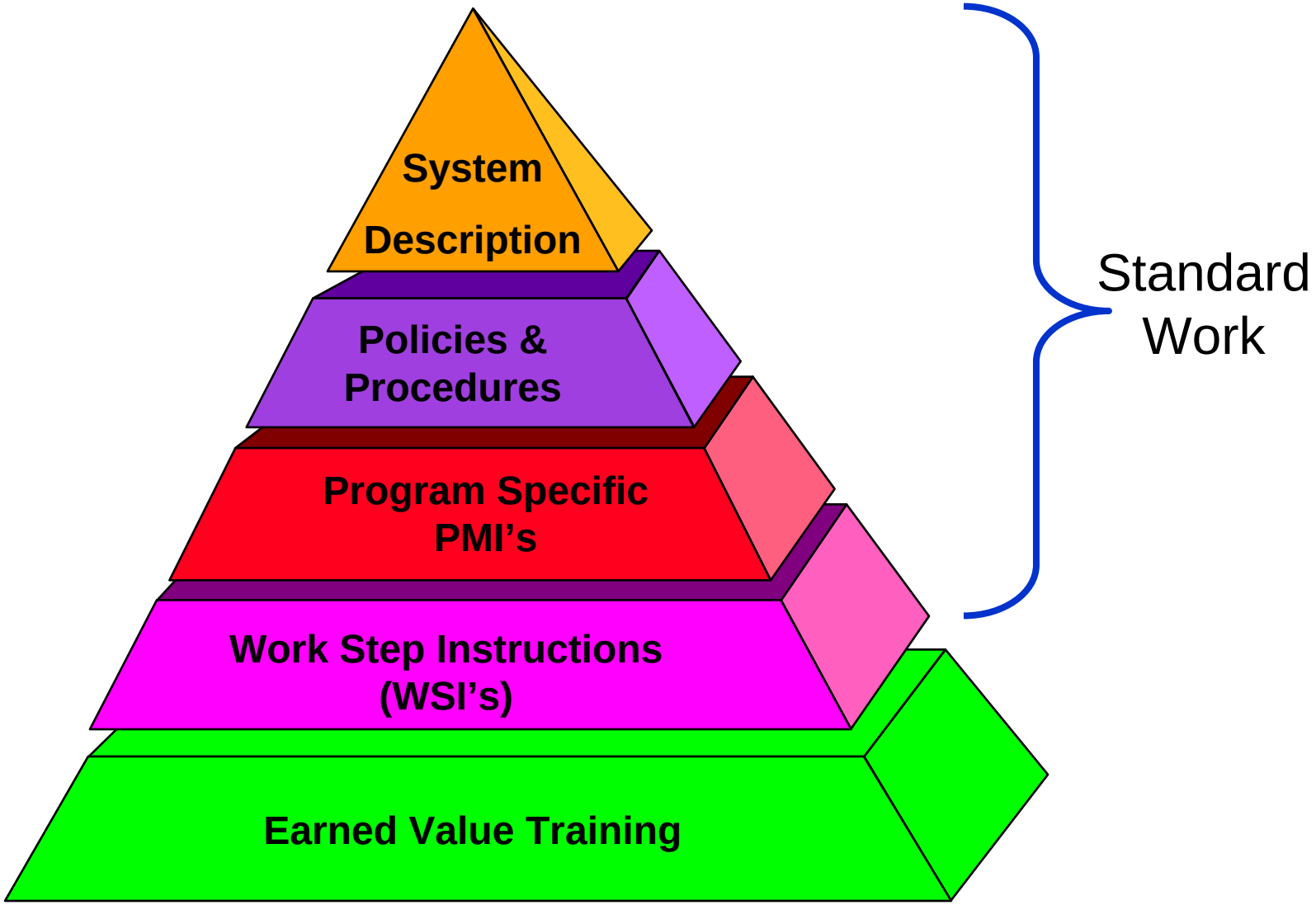
EVMS Standard Documentation and Work



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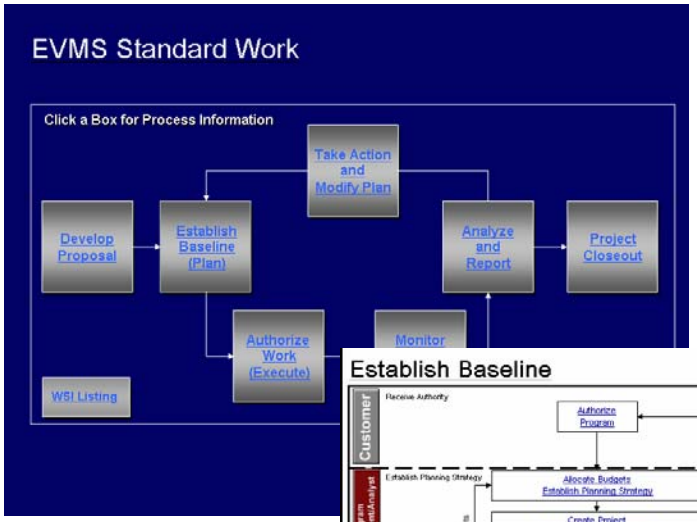

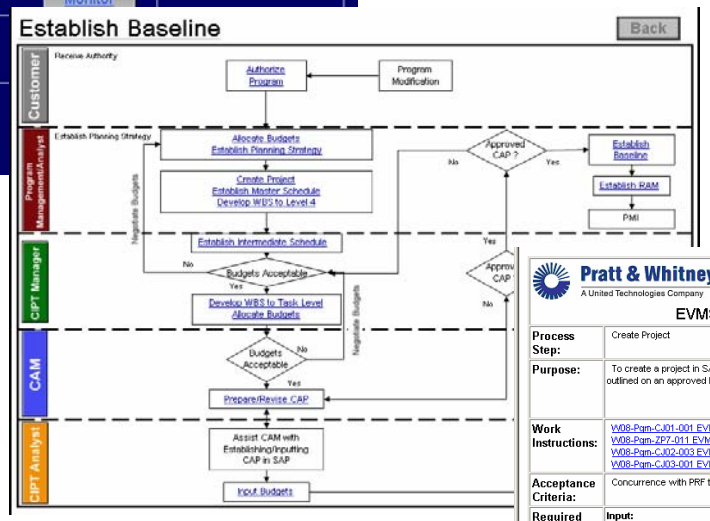

Standard Tools

Standard Process

Standard Work Step Instructions

Standard Training

Pratt & Whitney
A United Technologies Company

EVMS Standard Workflow Activity Page

Process Step:	Create Project	**Doc Number:**	FNSTWK-EVMS 2.2 Rev: 1
Purpose:	To create a project in SAP as outlined on an approved PRF.	**Discipline:**	Administrative
		Skill Rqmt:	Medium
		Training:	e*PRF User's Manual
Work Instructions:	W08-Pam-CJ01-001 EVMS Create SAP Project Definition & WBS W08-Pam-ZP7-011 EVMS WBS Exception Report W08-Pam-CJ02-003 EVMS Change SAP Project Definition & WBS W08-Pam-CJ03-001 EVMS Display SAP Project Definition & WBS		
Acceptance Criteria:	Concurrence with PRF team to Create Project in SAP		

Required Inputs:	**Input:**	**Format:**	**Source:**
	Project Request Form - Approved	ePRF	Contracts / Program Analyst/Acctg.
	Authorization to Proceed (Signed Contract, MAM, etc.)	Hard copy documentation/e-mail	PRF Initiator

Expected Outputs:	**Output:**	**Format:**	**Destination:**
	Project definition and work breakdown structure	SAP	PRF Distribution List

Tools:	e-PRF SAP
Norms and Standards:	Standard WBS PRF Application Procedure
Lessons Learned:	SAP Project Charts
Definitions:	Applied Research - Follows basic research. Determines/exploits potential of discoveries. Advances the state of the art. Basic Research

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Standard EVMS Processes

Business Process Elements

- ✓ Work Breakdown Structure (WBS)
- ✓ Baseline Plans
- ✓ Work Authorization
- ✓ Cost and Schedule Variances
- ✓ EAC Process
- ✓ Change Control
- ✓ Reporting
- ✓ EVMS Standard Work

Standard Processes Across Programs

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Pratt's EVMS Transformation

	FROM	TO
Roles and Responsibilities	• Inconsistent	• Consistent with IPD
Ownership of Process, Metrics, Systems and Tools	• Multiple	• Central EVMS Organization
Metrics	• Multiple	• Common
Process and Documentation	• Separate	• Single
Resource Plans	• Multiple Sources	• Based on Standard Work
Cost and Schedule Systems	• Multiple	• Single
Source of Management Data/Reports	• Multiple	• SAP wInsight

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Looking Back…

What Worked Well

- Business Process experts leading development
- Early involvement of end-users in integration testing
- Report development begun early
- Consistent Reporting Utility Through Transition (wInsight)
- 3+ Go-Live dress rehearsals for data conversion
- Co-location with of IT and Business Teams at go-live

Lessons-Learned

- The user interface matters – What is acceptable for working with a small amount of data may not be acceptable when working with large projects.
- Test system performance early…

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Moving Beyond "The System"

"In any organization, it is easier to implement new tools and processes than to change the habits and values of the people they are designed to serve."

Eric Verzuh, The Portable MBA in Project Management, 2003, John Wiley & Sons

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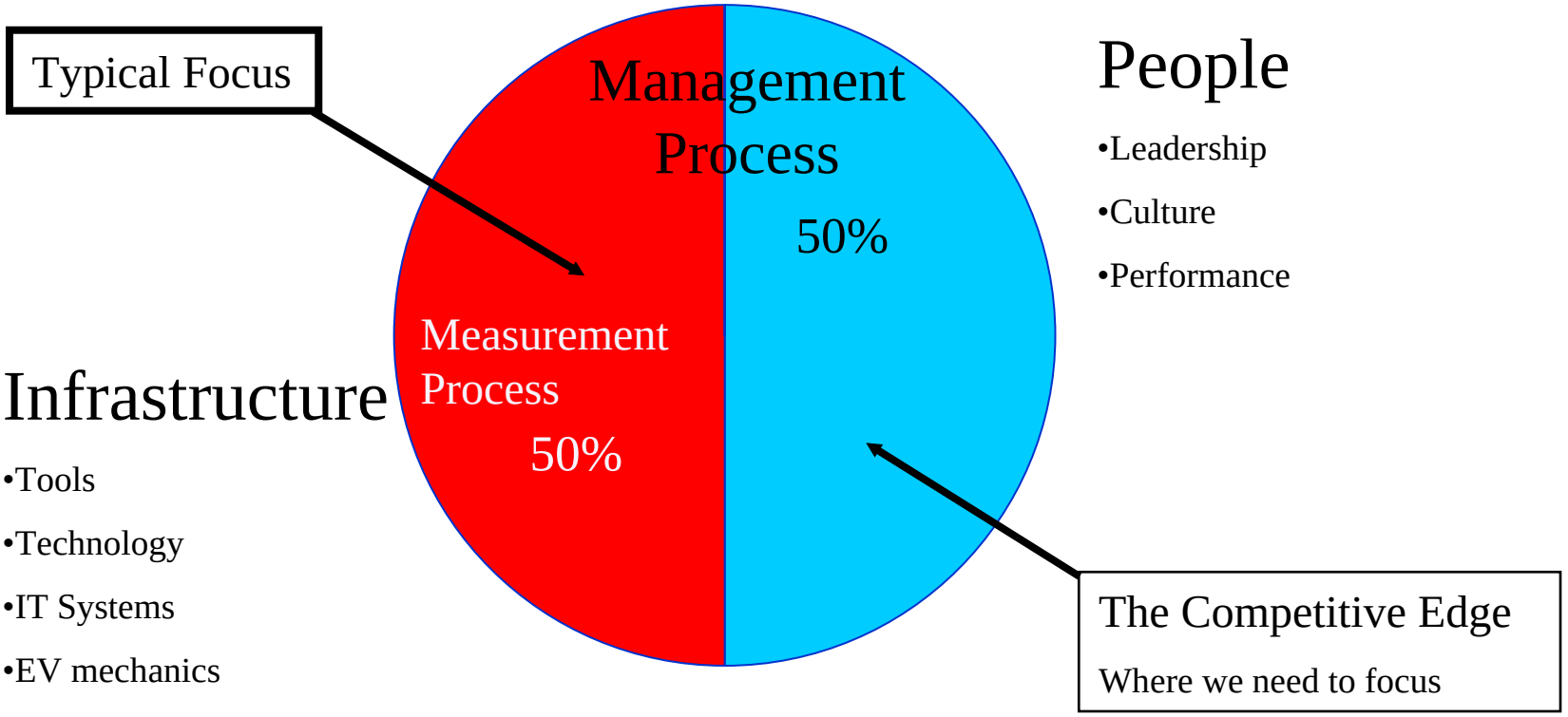
Moving Beyond "The System"

The Performance Gap



Eleanor Haupt, 16th Annual International Program Management Conference, "Organizational Impacts of Performance Management"

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Key Attributes of a Healthy Performance Culture

- **Leadership**
  - Words and actions reinforce importance of performance management
  - Continually asks "Why? How much? What can we do?"
  - Top management uses portfolio performance data to balance resources, provide direction, and manage portfolio
  - Performance management inherent part of project management
- **Culture**
  - Metrics at the right time, at the right level, to the right people
  - Variances are cherished for insight they reveal into performance
  - Open relationship with customer
  - Healthy and realistic project plans highly valued
- **Performance**
  - Continuous learning
  - Project managers use data to manage and control performance
  - Effective project managers are rewarded for their actions
  - Data integrity continually monitored and maintained

Eleanor Haupt, 16th Annual International Program Management Conference, "Organizational Impacts of Performance Management"

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Remove the Fear of Variances

- Need a significant change in attitude about variances
  - Need to overcome fear of reporting the truth
  - Variances are neutral – how you react to them is the key!
- Create different environment
  - Project managers are not punished for variances
  - Instead, project managers are rewarded for
    - Reporting accurate status
    - Effective and integrated analysis across project
    - Taking effective action to bring project under control
- Customer: reward contractors for effective performance management
  - Award fee contracts should focus on effective management use
    - Not "objective" metrics that can be distorted

Eleanor Haupt, 16th Annual International Program Management Conference, "Organizational Impacts of Performance Management"

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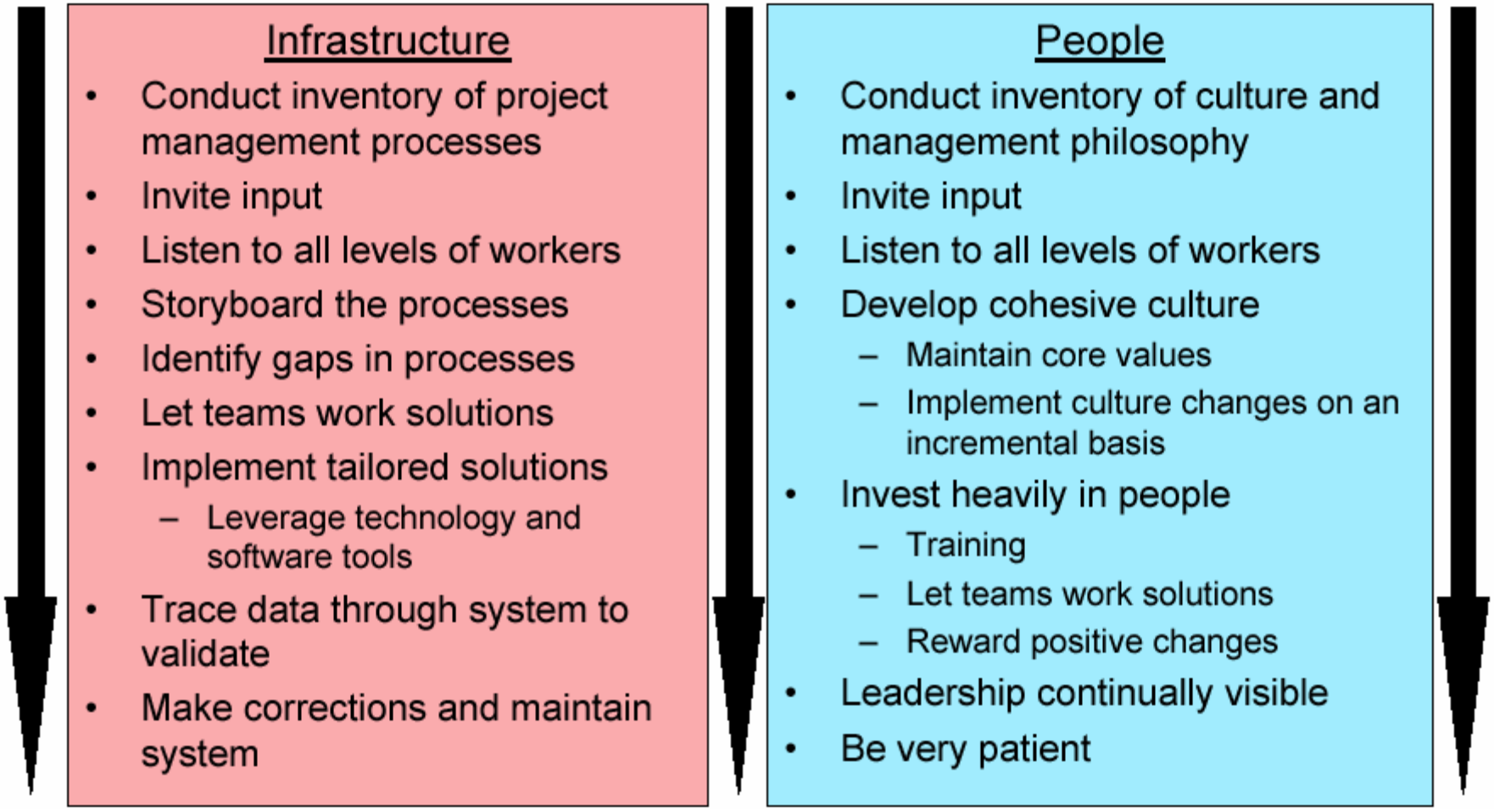
Focus on Both Sides When Implementing Performance Management



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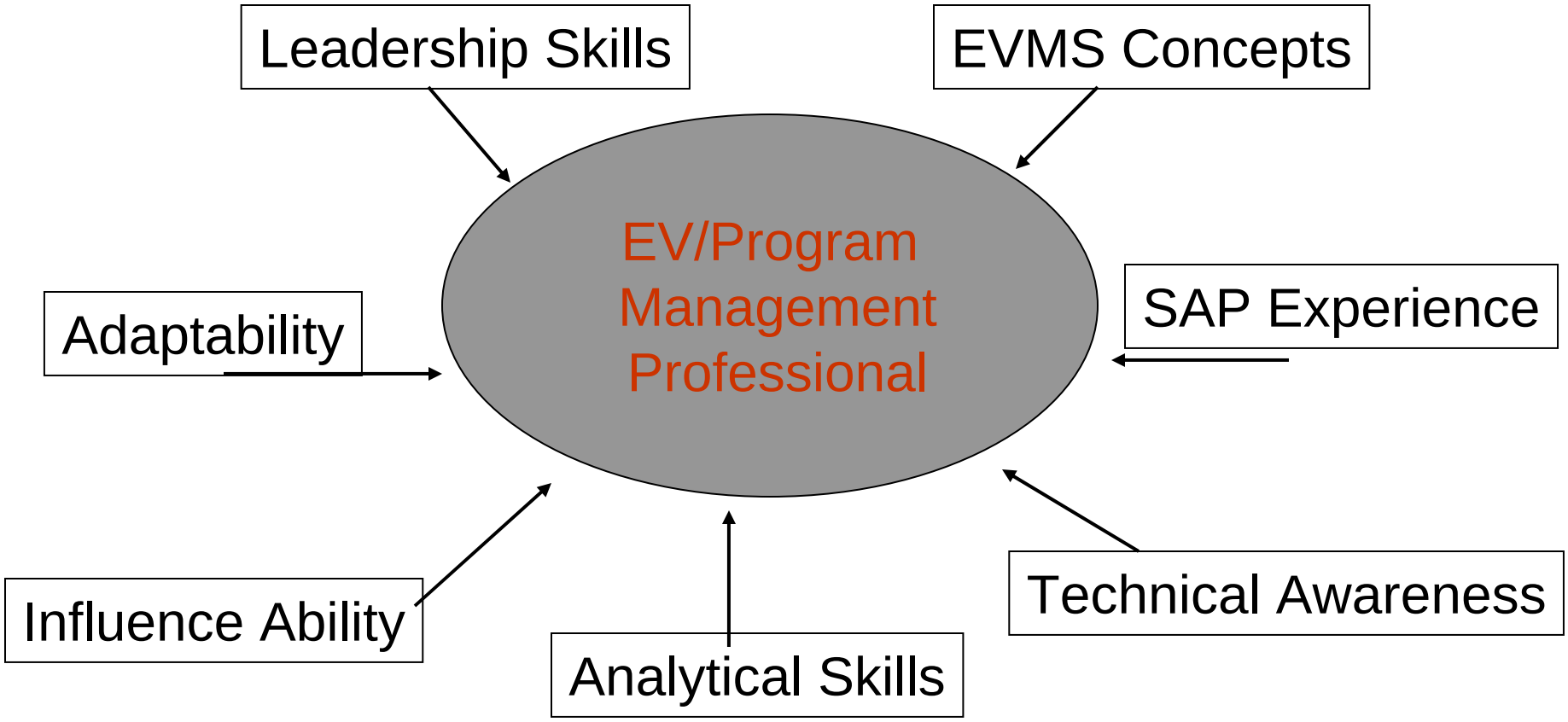
Building Blocks for EV Analysts



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Initiative Teams

- Communications
- Employee Satisfaction
- Standard Work
- Reporting
- Process Improvement
- Tools
- Training

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Training Programs

- EVMS101 Training
- SAP Training
- wInsight Training
- Business Warehouse Training
- e-CSVar Training
- EV Tool Box
- Executive Awareness

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EV Analyst Proficiency Matrix

	Analyst Proficiency Levels					Management Proficiency Levels	
	ENTRY LEVEL ANALYST	PROFICIENCY LEVEL 1	PROFICIENCY LEVEL 2	PROFICIENCY LEVEL 3	PROFICIENCY LEVEL 4	PROFICIENCY LEVEL 1	PROFICIENCY LEVEL 2
RESPONSIBILITIES:	Work with higher proficiency level analysts and Team Leaders to support CIPT, IPTs, or Prog. Mgt requirements. Interface with EV processes and tools under the guidance and supervision of higher proficiency level analysts and Team Leaders.	Work with higher proficiency level analysts and Team Leaders to support CIPT, IPTs, or Prog. Mgt. requirements. Interface with EV processes and tools under the guidance and supervision of higher proficiency level analysts and Team Leaders. Directly interface with CIPTs, CAMs and Program management to gather resource planning/EV requirements.	Work with higher proficiency level analysts and Team Leaders to support CIPT, IPTs, or Prog. Mgt. requirements. Interface with EV processes and tools with minimal guidance and supervision of higher proficiency level analysts and Team Leaders. Directly interface with CIPTs, CAMs and Program management to provide basic analysis and implement EV techniques. Advocate for proper application of EV process. Provide guidance to lower proficiency level analysts.	Work with Team Leaders to support CIPT, IPTs, or Prog. Mgt requirements. Interface with EV processes and tools with little to no guidance and supervision. Directly interface with CIPTs, CAMs and Program management to provide intermediate-level analysis and implement EV techniques. Advocate for proper application of EV process. Provide guidance to lower proficiency level analysts.	Work with Team Leaders to support CIPT, IPTs or Prog. Mgt. requirements. Interface with EV processes and tools independently. Directly interface with CIPTs, CAMs and Program analysts/managers to provide complex level analysis and EV techniques. Act as an EVMS area focal point and be viewed as a knowledgeable finance resource. Advocate for proper application of EV process. Provide leadership to lower proficiency level analysts as directed by Team Leaders.	Direct, develop and enable teams of analysts to complete all EV system transactions and processes within the EV guidelines. Support and advise internal and external customers and act as the EV focal point for area of responsibility. Lead, coach, and train direct reports and provide career development. Responsible for staffing based on resource requirements. Advocate for proper application of EV process. Act as a backup for analysts when necessary.	Direct, develop and enable analyst teams to meet customer requirements associated with EV system transactions and processes. Lead, coach, and train analyst teams and provide career development and training guidance. Responsible for staffing based on resource requirements. Develop and implement EV processes/systems. Provide organizational visibility and guidance in training, standard work, communication, systems, and employee satisfaction/development. Act as the EVMS focal point and advocate for proper application of EV process.
INTERDEPENDENCE	Work with direction from higher proficiency level analysts and Team Leader.	Work with direction from higher proficiency level analysts and Team Leader.	Work with minimal direction from higher proficiency level analysts and Team Leader.	Work with little to no direction from higher proficiency level analysts and Team Leader.	Work independently.	Work independently and provide team vision.	Work independently and provide organizational vision.
INTERPERSONAL SKILLS	Possess: 1. Good listening skills 2. Good written and oral communication skills 3. Positive attitude 4. Team-player 5. Strong work ethic	Possess Entry Level skills plus: 1. Take initiative	Possess Level 1 skills plus: 1. Start developing positive relationships 2. Good adaptability skills 3. Good time management skills 4. Good organizational skills	Possess Level 2 skills plus: 1. Expand positive relationships 2. Be assertive 3. Demonstrate basic leadership skills 4. Enhanced adaptability skills	Possess Level 3 skills plus: 1. Establish a network of positive relationships 2. Act as a role model 3. Delegate with positive influence 4. Demonstrate good leadership skills 5. Demonstrate coaching skills 6. Strong presentation skills	Possess Analyst Level 4 skills plus: 1. Good conflict management skills 2. Demonstrate advanced leadership skills 3. Positive employee relationship skills	Possess Management Level 1 skills plus: 1. Ability to communicate with senior management 2. Possess strong organizational communication skills
BUSINESS COMPETENCIES	1. Focus on assigned deliverables 2. Focus on deadlines 3. Focus on customer needs	Possess Entry Level skills plus: 1. Basic understanding of assigned deliverables	Possess Level 1 skills plus: 1. Demonstrate basic forward thinking skills 2. Basic tactical thinking	Possess Level 2 skills plus: 1. Intermediate forward thinking skills 2. Generate innovative solutions 3. Basic business judgment skills 4. Ability to balance customer needs	Possess Level 3 skills plus: 1. Advanced forward thinking skills 2. Sound business decisions	Possess Level 4 skills plus: 1. Define, develop and execute strategies 2. Evaluate and implement innovative solutions	Possess Management Level 1 skills plus: 1. Authorize strategies 2. Demonstrate complex business decision-making
CREDENTIALS	AA/AS/BS/BA degree and/or equivalent experience.	AA/AS/BS/BA degree and 1-2 years experience or equivalent qualifications. Formal training in EV processes.	BS/BA degree in related field plus 3-5 years experience or equivalent qualifications.	BS/BA degree in related field plus 4-7 years experience or equivalent qualifications.	BS/BA degree in related field plus 4-7 years related experience.	BS/BA degree in related field, MS/MBA preferred, plus 6-10 years related experience.	BS/BA degree in related field, MS/MBA preferred, plus 6-10 years related experience.
PROCESS/PRODUCT KNOWLEDGE	Possess: 1. Introductory understanding of EV process	Possess Entry Level skills plus: 1. Basic understanding of budgeting 2. Basic understanding of EV methodology 3. Basic understanding of efficient planning methodologies 4. Understanding of work breakdown structure	Possess Level 1 skills plus: 1. Intermediate understanding of budgeting 2. Recognition of proper EV methodology 3. Basic understanding of CIPT/Program objectives 4. Basic understanding of the EAC process 5. Expand knowledge of efficient planning methodologies	Possess Level 2 skills plus: 1. Advanced knowledge of budgeting 2. Intermediate understanding of CIPT/Program objectives 3. Intermediate understanding of the EAC process 4. Utilize PSW/product knowledge to build efficient planning methodologies	Possess Level 3 skills plus: 1. Advanced understanding of CIPT/Program objectives 2. Advanced understanding of the EAC process	Possess Level 4 skills plus: 1. Ability to teach and influence the use of proper application of EV processes	Possess Management Level 1 skills plus: 1. Ability to create/enhance EV processes
SYSTEMS	Possess: 1. Introductory understanding of Microsoft Word, PowerPoint, and Excel 2. Possess the ability to learn EV software systems and tools	Possess Entry Level skills plus: 1. Basic understanding of Microsoft Word, PowerPoint, and Excel 2. Basic understanding of SAP, BW, and wInsight	Possess Level 1 skills plus: 1. Intermediate understanding of Microsoft Word, PowerPoint, and Excel 2. Intermediate level of knowledge and understanding of SAP, BW, and wInsight 3. Basic level of knowledge and understanding of system-level scheduling techniques	Possess Level 2 skills plus: 1. Advanced understanding of Microsoft Word, PowerPoint, and Excel 2. Basic understanding of Microsoft Access 3. Advanced knowledge and understanding of SAP, BW, and wInsight 4. Intermediate knowledge and understanding of system-level scheduling techniques	Possess Level 3 skills plus: 1. Ability to teach Microsoft Word, PowerPoint, and Excel 2. Intermediate understanding of Microsoft Access 3. Ability to teach SAP, BW, and wInsight applications 4. Advanced knowledge and understanding of system-level scheduling techniques	Possess Level 4 skills plus: 1. Intermediate to advanced understanding of Microsoft Access 2. Ability to teach system-level scheduling techniques	Possess Management Level 1 skills plus: 1. Perform system troubleshooting 2. Provide vision for development of system enhancements

Measure the Process Not Just the Output

Some Possible Measures

Measure	Method
Vertical and Horizontal Alignment	Surveillance
Objective Measurement for EV	Surveillance
Retroactive Changes	Manual/Electronic Collection and Review
Offline Adjustments for BCWS or BCWP	Manual/Electronic Collection and Review
Adequate Variance Analysis	Manual / Electronic
CAMS Identified	Electronic
CAMS Trained	Manual Collection

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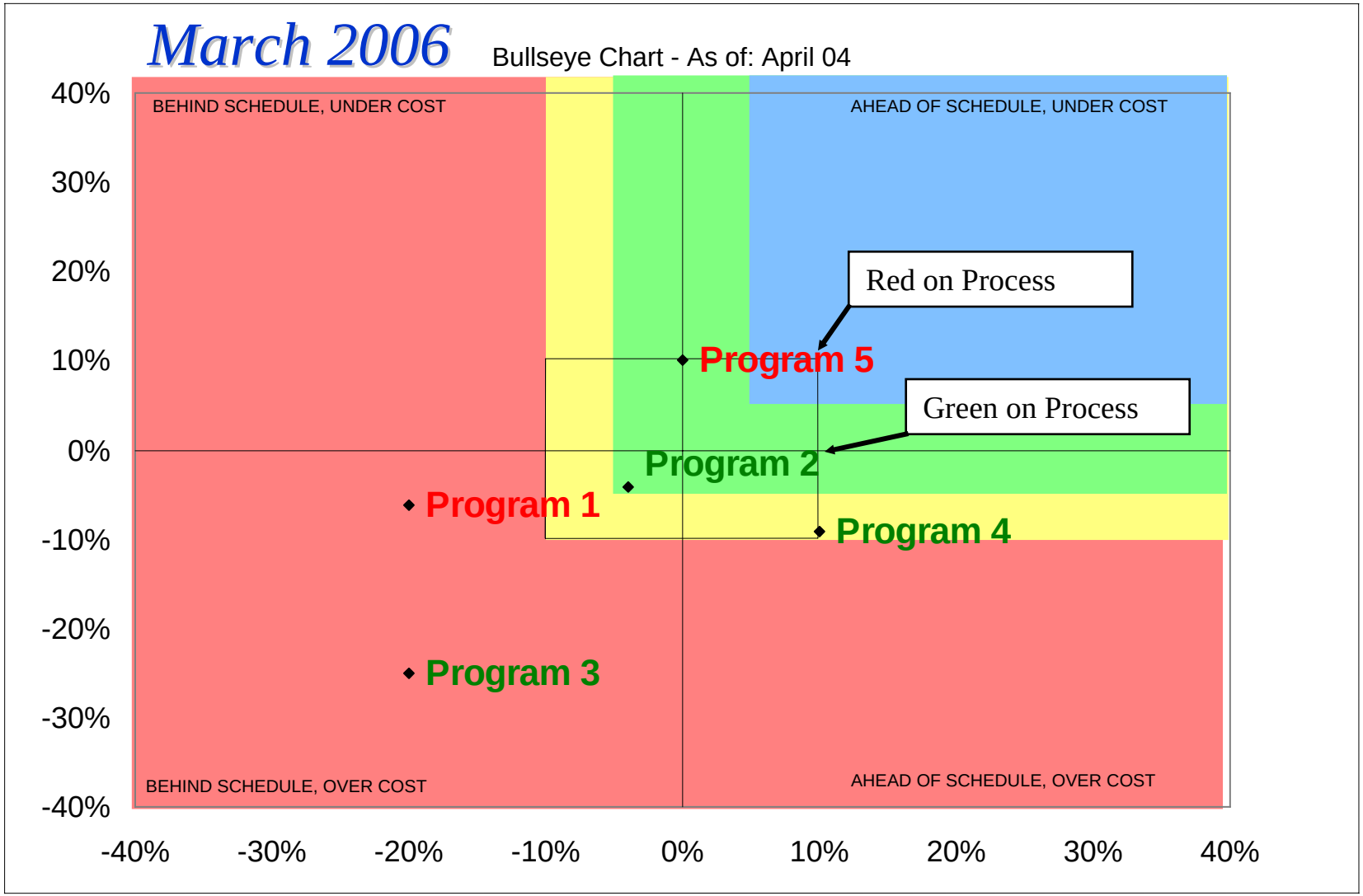
Measure the Process Not Just the Results



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Summary

- ERP/SAP is a game changer for Pratt & Whitney
- Single instance strategy allows world wide visibility and process consistency
- Unprecedented level of data available to drive rapid decisions
- EVMS – process, tools, organization, and culture
- Communication,Training and Retention are Crucial
- Full application of SAP to Program Management/EVMS
- The ERP and EVMS journey continues…

Thank you!

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